

BORASSODENDRON (PALMAE) IN THE SOUTHEAST ASIAN FOSSIL POLLEN RECORD

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SUMMARY

Borassodendron machadonis pollen occurred throughout the Holocene pollen record of Nong Thale Song Hong, Thailand, until about 4000 BP. It was also present in one sample from Khok Phanom Di, Thailand, and in the Mahakam Delta, Kalimantan, records, but *B. machadonis* has not been reported from the modern flora of Kalimantan. *Borassodendron machadonis* pollen differs greatly from that of *B. borneense*, which is found on the island of Borneo.

Key words: *Borassodendron*, fossil pollen, Indonesia, Thailand.

There are two species in the genus *Borassodendron*, *B. borneense* J. Dransf. and *B. machadonis* (Ridl.) Becc. (Palmae: Coryphoideae), and they differ in pollen morphology (Ferguson et al., 1987). *Borassodendron borneense* is monolete (monosulcate) (Ferguson et al., 1987, f. 1A–F), while *B. machadonis* is monoporate (Thanikaimoni, 1971, pl. X: 178–184; Ferguson et al., 1987, f. 2A–G). The pollen grains of both are large and distinctive. *Borassodendron machadonis* has a southern Thailand–northern Peninsular Malaysia distribution, and seemed at one time to be restricted to slopes at the foot of limestone (Dransfield, pers. comm.), but also occurs in hill dipterocarp forest on shales in Kelantan. *Borassodendron borneensis* is only known from Borneo [north-west according to Dransfield (1979); but Whitmore (1978) says north-east, and does not mention the north-west, cite Dransfield] where it is widespread but always quite localised and absent from many places suitable for its growth. The distribution may have been altered by man in some areas (Dransfield, 1972) as the apex is eaten by humans, who even cut the juveniles. *Borassodendron borneensis* differs from *B. machadonis* in that it has a much smaller male inflorescence, with six stamens, as opposed to nine to fifteen, has a smaller female inflorescence, and varies somewhat in leaf morphology. Both are unarmed, dioecious, solitary fan palms up to 20 m tall.

Borassodendron pollen has been reported from the Mahakam Delta, Kalimantan (Cartini & Tissot, 1985) and the fossil pollen is illustrated on their plate IV: 10, 11. These illustrations demonstrate that it was *B. machadonis* and not *B. borneense* pollen. It seems to have been absent from modern pollen samples and to have been grouped with the other Palmae pollen in the published pollen percentages. Palm pollen occurs fairly continuously throughout a record ranging from the Upper Pliocene to the present but only *Nypa* has been recorded separately and it is therefore not possible to comment upon its distribution pattern throughout the core.

† Deceased on 11 October 2000.

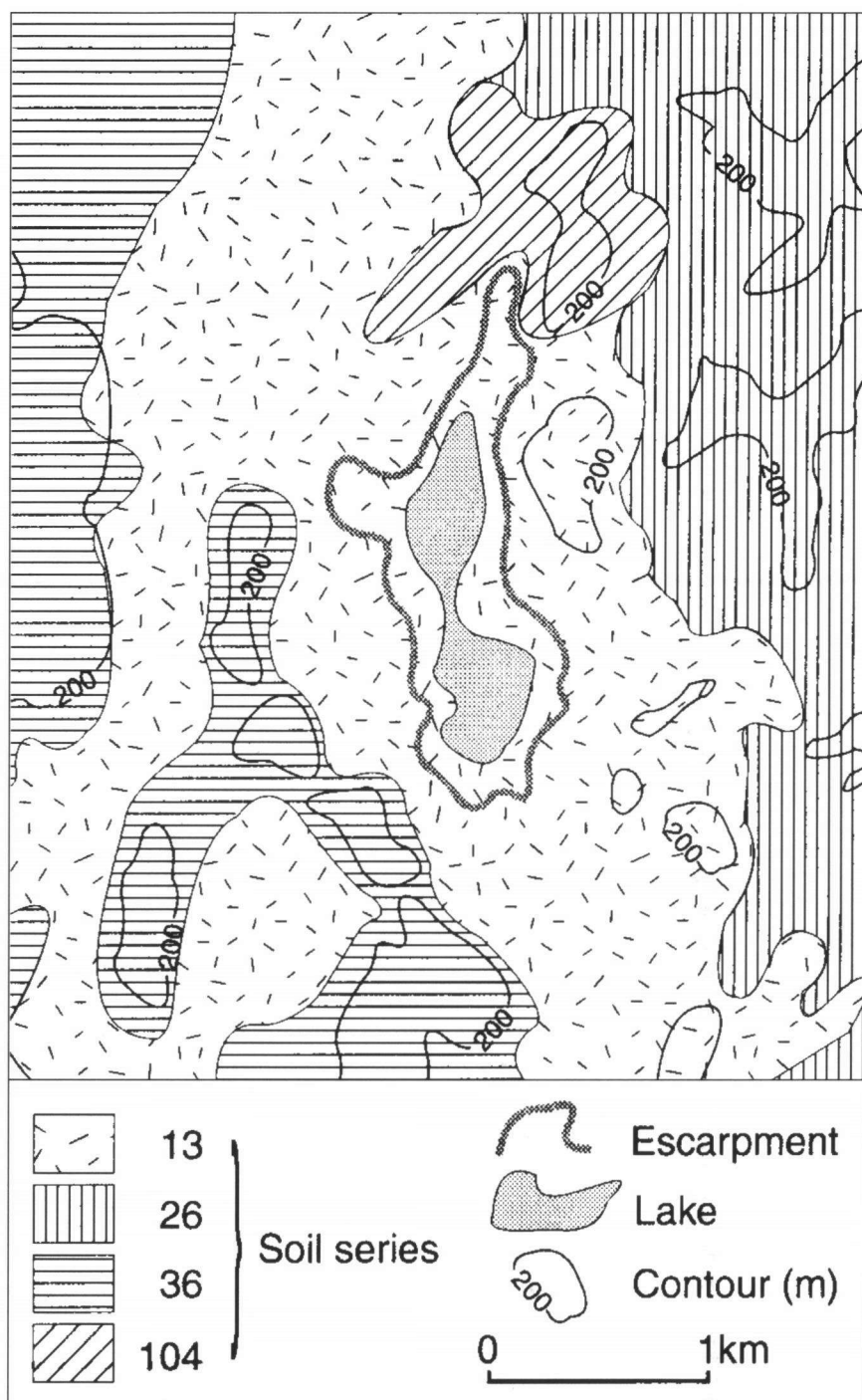


Fig. 1. Nong Thale Song Hong: topography.

A single grain of *Borassodendron machadonis* was found in the 3.99 m sample from core BMR2 (Maloney, 1991) extracted through a rice field north of the archaeological site of Khok Phanom Di in the Bang Pakong Valley of east central Thailand. Smitinand (1980) recorded only Trang and Pattani names for the species, and it is likely that the palm was not growing in this area but that the pollen was transported there by coastal currents. The pollen spectrum was dominated by Rhizophoraceae and the sediments consisted of green, fine grained, shallow water marine or inter-tidal clays.

In the lack of more information about the Kalimantan core, the most continuous record of *B. machadonis* seems to be mine from the small, shallow lake called Nong Thale Song Hong which is located at 7° 52' N, 99° 28' 50" E in Trang Province, north of Trang. This site is at about 100 m altitude and has no outflowing or inflowing streams. A 3 m core was extracted by Dr. Lisa Kealhofer (College of William & Mary, Virginia)

Table 1. *Borassodendron machadonis* pollen at Nong Thale Song Hong, South Thailand, and its estimated age.

Sample number	Depth (mm)	Estimated age	Percentage of total pollen and pteridophyte spores	Pollen concentration/cc
1	55	400	0	0
2	105	764	0	0
3	155	1128	0	0
4	205	1492	0	0
5	255	1855	0	0
6	305	2219	0	0
7	355	2583	0	0
8	405	2917	0	0
9	455	3311	0	0
10	505	3674	0	0
11	555	4038	1.87	880
12	605	4402	0.48	142
13	655	4766	1.46	735
14	705	5130	0.44	327
15	755	5493	0	0
16	805	5857	0.48	179
17	855	6221	0	0
18	905	6568	0.84	466
19	955	6908	1.84	501
20	1055	7588	0.98	276
21	1105	7928	0.49	201
22	1155	8268	0.43	320
23	1205	8608	0	0
24	1255	8948	0.86	279
25	1305	9288	0	0
26	1355	9629	0	0
27	1405	9968	0	0
28	1455	10308	0	0
29	1505	10648	0	0

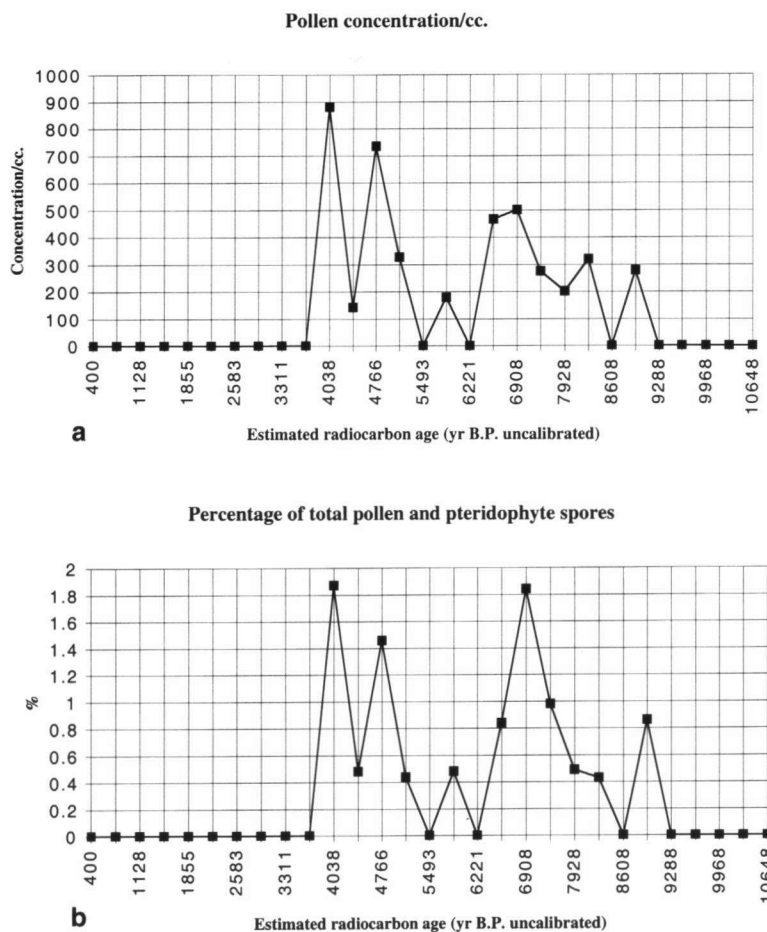


Fig. 2. Nong Thale Song Hong. *Borassodendron machadonis* pollen concentrations/cc (a) and pollen percentages (b).

and Dr. Joyce White (University of Pennsylvania Museum) in December 1994 where the water was at its deepest using a modified Livingstone piston sampler. The part of the core pre-dating around 10,650 BP was largely devoid of pollen, but a sequence covering the complete Holocene could be reconstructed, although none of the samples was especially pollen rich, and the sedimentation rate proved so slow that the sampling interval of 5 cm yielded data of rather coarse resolution. Nevertheless, the vegetation could be seen to be in a state of constant flux, partly due to burning, which was probably of both natural and human origin. The nature of the site (Fig. 1) precludes straightforward recognition of climatic changes but is ideal for investigating local vegetation changes, both hydrosereal and on the adjacent slopes. The lake is surrounded by steep slopes, with a low altitude plateau above these. The highest point in the region only reaches up to 400 m and is situated 14 km to the south-west of the site.

The approximate ages of the samples in which *Borassodendron* pollen grains occur has been estimated using two AMS radiocarbon dates of $10,820 \pm 50$ BP (Beta-Analytic 106537) from 156–160 mm depth and 6330 ± 50 BP (Beta-Analytic 106539) from the 84–90 mm level, disregarding the errors of the determinations. Both dates are uncalibrated and the sediment was pre-treated at Beta and fed through the mass spectrometer at Oxford. *Borassodendron* first entered the record around 8950 BP (Table 1, Fig. 2) and had an almost continuous, but low level, record until about 4000 BP, after which it disappeared entirely. However, its highest percentage and concentration figures are in this final sample. Its disappearance from the pollen record could relate to forest clearance, or a combination of forest clearance and climatic change, either in terms of macro-climate or in edaphic conditions. Microfossil charcoal peaks became more frequent then, as did disturbance indicators such as *Macaranga/Mallotus* and *Urticaceae/Moraceae*, but there was also quite a significant one around 8600 BP. Disturbance indicators were also commoner in many of the earlier levels where *Borassodendron* representation was depressed but there is not a consistent correlation between all of the curves.

At the moment this record is of interest from a phytogeographical point of view, but *Borassodendron machadonis* is very rare in Thailand and Peninsular Malaysia today, has a large, very distinctive pollen, cf. Ferguson et al. (1987) and could be a useful indicator type if more was known of its present-day ecology. Smitinand (1976) found this species at 120–160 m altitude in the Surin Islands, similar heights to those of the study region, but it might be confined to locations where the soils are base rich, the shales mentioned by Dransfield may not be particularly acid, or to require a particular amount of moisture. As it has been found in both lowland and hill forest it may not be especially temperature sensitive.

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